

2017 HOLSUM DAIRIES GREEN TIER ANNUAL REPORT TO WDNR

*Partners in
Agriculture*

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Dairy Manager's Annual Report of Holsum Dairy's Twelfth Year of Green Tier Qualification

Holsum Dairies is always on a mission to improve our systems, environmental sustainability, and decrease our environmental footprint. 2017 was no different. Considerable effort was put in several areas throughout the dairy, but I will focus on discussing just a few.

In 2016, we worked diligently to repair the banks and cement armor two of our manure lagoons at our Elm dairy. Unfortunately, due to the wet year, we were not able to get lagoon #2 repaired and cemented. We were very fortunate to have excess manure storage that allowed us to get through the year without putting extra manure in lagoon #2. We made it through the winter of 2017 with little stress and have been able to make progress in 2018 on the last lagoon at Elm.

For 2016, we tried doing some cover crops for the first time. Results were mixed and definitely required different management. For 2017, we expanded acres to about 250 acres of fall air seeded rye. We were impressed in the spring with the growth of the rye and the soil texture. We tried a single pass harrow in the spring of 2018 on those fields and then planted. Results were impressive and will continue to monitor and expand our cover crop use.

During the process of working on the manure pits in 2016, we decided to televise our manure flume pipes and check for water leaks. The results were clear that we had several locations where ground water was infiltrating into our manure flumes. Brad, the camera technician from Speedy Clean, estimated a total of over 30 gpm from all the various leaks. We consulted a Professional Engineer and determined an appropriate course of action to resolve the leaks. I am happy to say that the repairs went very well and have been verified by remote camera. We estimate a manure volume reduction of between 15 and 20 million gallons due to the repair of these water leaks.

A biological sulfur scrubber was installed at Irish dairy in 2017. The scrubber uses microbial activity to convert the hydrogen sulfide in our biogas into a solid sulfur slurry that is then mixed with our manure stream and land applied as fertilizer. The process has been very successful resulting in a reduction in hydrogen sulfide in our biogas from an average of 3,500 ppm to less than 100 ppm. The result is dramatically less corrosion to our biogas engines and less sulfur emissions in the exhaust of our generators.

Finally, we converted the ventilation in our holding area at Irish Dairy to cross ventilation. This move resulted in greater cow cooling and comfort. It also resulted in replacing 28 1.5 hp motors with 11 electric motors of the same horsepower. The new fans are considerably more energy efficient (as measured by cfm per watt), dramatically quieter for the cows and people, and has improved air flow in this crowded area. It is nice to see projects benefit the cows, the environment, and the bottom line of a business.

Robert Nagel, DVM, MS

Manager, Holsum Dairies, Hilbert, Wisconsin 54129

2017 Holsum Dairy Objectives and Targets

Objective 1 (reduce our carbon footprint): Reduce trucking of manure by increasing underground manure piping.

Target 1: Reduce 2016 hauling miles by 12,000

Result: Due to permitting issues, pipeline was delayed.

Objective 2: (minimize the dairies' impact on the environment) Decrease hydrogen sulfide emissions from Irish Dairy's anaerobic digester generators.

Target 1: Reduce H₂S emissions by 90%.

Result: Scrubber was successfully installed and has reduced the hydrogen sulfide content of the methane from an average of 3,500 ppm to consistently less than 50 ppm.

Objective 3 (reduce energy consumption): Reduce energy consumption in the milking parlor facilities.

Target 1: Reduce energy use by lowering the number of cow cooling fans and increasing their efficiency at the Irish Dairy parlor. Replace **28** 1.5 horsepower fans with **13** 1.5 hp fans, reducing electrical use by a calculated 54%.

Result: The holding area is greatly improved. We ended up only needing 11 instead of 13 fans.

Target 2: Reduce energy use in both parlors by replacing metal halide fixtures with Light Emitting Diode (LED) fixtures in the 24/7 milking parlor

Result: Parlor lights were all replaced resulting in better working conditions and notably less energy consumption.

Objective 4: (conserve erodible soil)

Target 1: Incorporate cover crops on 20% of owned crop land

Result: Due to weather conditions only about 14 % of our land was placed in cover crops. The acres in cover crops were very successful.

2018 Holsum Dairy Objectives and Targets

Objective 1 (Improve working conditions and reduce energy consumption): Replace old energy inefficient metal halide lights with new more energy efficient LED lights.

Target 1: Decrease energy consumption on barn lighting by 25 %

Objective 2: (Conserve erodible soil): Using agriculture practices that ensure soil loss is kept to a minimum and below the T value for given soil.

Target 1: Incorporate cover crops on 25% of owned crop land

Objective 3: (minimize the dairies' impact on the environment): Explore low disturbance manure applicators.

Target 1: Demonstrate and purchase low disturbance manure applicator consistent with current low or no till practices.

Target 2: Increase soil organic matter, aggregate stability, and water infiltration rates as a result of less soil disturbance.

Objective 4 (reduce fossil fuel consumption): Decrease idle time on equipment to reduce the amount of fossil fuel burned unnecessarily.

Target 1: Implement use of off timers in payloaders to decrease idle time when operator is not in seat. We want to decrease idle time by 40 % for our loaders used to feed cows.

Summary of digesters' effect on the local community:

Not only do the digesters at Holsum play a large role in the dairy's waste management, they also have a significant impact on the surrounding community.

Briess Industries, a local Green Tier member, is our largest off site by-product contributor.** Irish Dairy accepted into its digesters **2,672,610 gallons** of 'waste' from area businesses. Elm Dairy accepted into its digesters **10,194,544 gallons** of 'waste' from area businesses.

ELECTRICITY FROM MICROBES	2013	2014	2015	2016	2017
Liquid 'waste' kept out of sewage treatment plants (gallons):	12,107,756	11,567,865	12,832,572	10,564,711	12,867,154

** Others include local restaurants, a school, KayTee Products, two long term care facilities and Foremost Farms USA.

HISTORICAL SUPPORTING DATA

Regulated topics:

Manure Metrics

Manure composition is of interest to us for our Nutrient Management Plan (NMP), as well as for minimizing our environmental footprint. After capturing the energy and fibrous material from cow "waste", we have effluent with 82% less dry matter, 32% less nitrogen, 75% less phosphorous pentoxide (44% phosphorus), and 49% less potassium oxide (83% potassium) when compared to undigested manure values.

Weather changes kept us on our toes!

Rain and fog delayed timely lagoon emptying, but our own crew's diligence allowed complete emptying of Elm Dairy's lagoons.

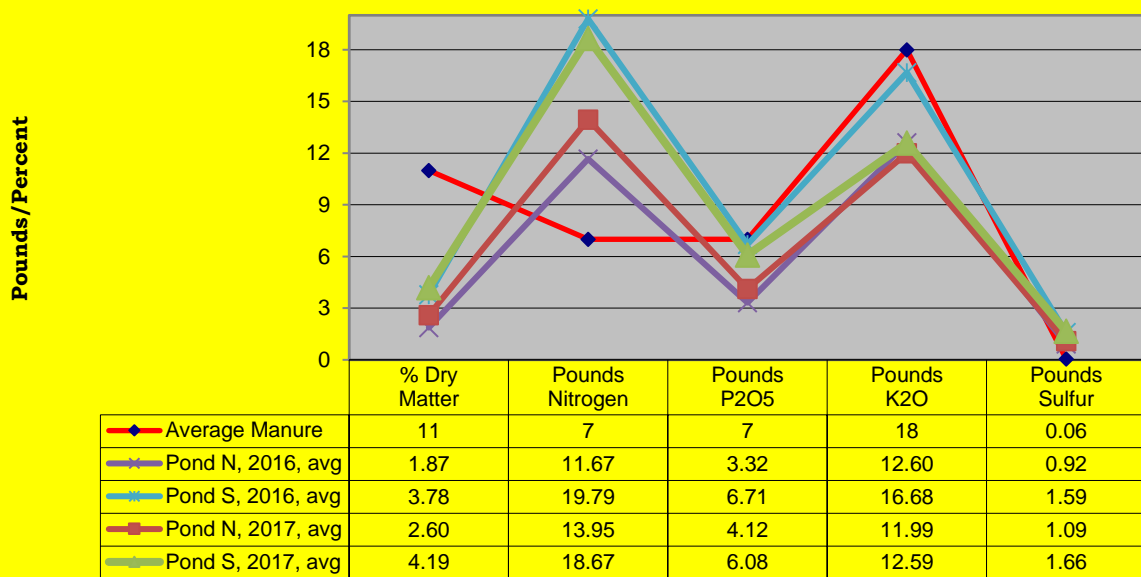
Because of the wet fall, we are once more reporting "Transfer" as one method of judiciously returning manure nutrients to the land. "Transfer" means that lagoon contents are trucked to a pit or a holding tank near a field; they are then land applied via drag hose pulled by a tractor.

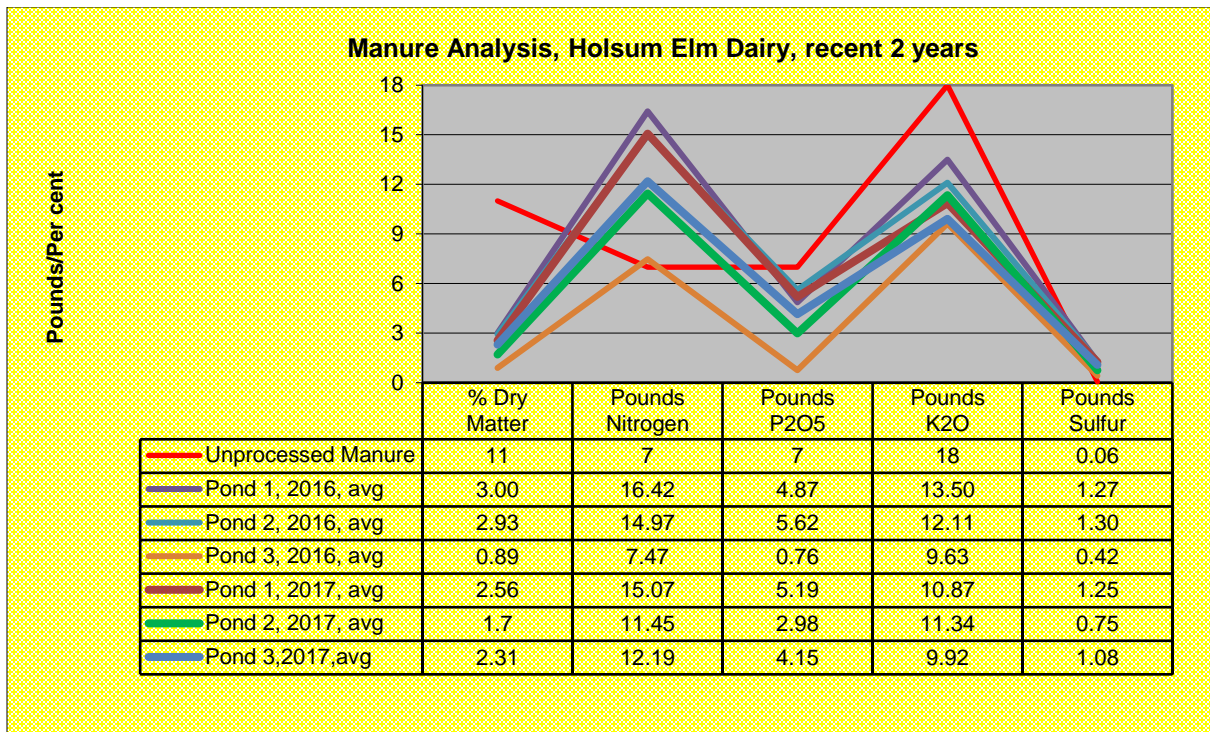
2013 gallons applied	130,322,433 (Irish and Elm Dairies and Calf Ranch young stock)
2014 gallons applied	120,554,066 (Irish and Elm Dairies and Calf Ranch young stock)
2015 gallons applied	170,958,120 (Irish and Elm Dairies and Calf Ranch young stock)
2016 gallons applied	165,247,727 (Irish and Elm Dairies and Calf Ranch young stock)
2017 gallons applied	160,784,173 (Irish and Elm Dairies and Calf Ranch young stock)

Manure Application Breakdown

	Total gallons	Irish total gallons	Irish transfer	Irish % hosed	Elm total gallons	Elm transfer	Elm % hosed	Total % transfer	Total % hosed
2013	130,322,433	49,364,616	7,910,114	73%	80,957,817	32,986,767	35%	32%	49.50%
2014	120,554,066	59,786,819	23,159,046	58%	60,767,247	30,845,262	27%	45%	42%
2015	170,958,120	72,823,698	36,364,438	49%	98,134,422	52,006,930	29%	52%	37%
2016	165,247,979	66,481,727	34,972,125	48%	98,767,252	66,602,787	33%	54%	39%
2017	160,784,173	71,632,291	28,794,553	54%	89,151,882	59,466,567	22%	54%	36%

Manure Analysis, Holsum Irish Dairy, 2 recent years





The significance of the digested manure numbers in the previous graphs is:

- Less phosphorus builds up in the soil; it no longer is available to run into streams and contribute to algae bloom.
- We provide phosphorus, potassium (potash) and water to the alfalfa crop. By applying the effluent when the soil is relatively dry and the plant is actively growing, we reduce the likelihood of phosphorus leaching through the root zone. We reduce the purchase, transport and additional application of fertilizer.

Water usage

*"When the well's dry, we know the worth of water."
—Benjamin Franklin*

We are tracking our water usage from each well at each farm, as required by statute (Wisconsin Pollutant Discharge Elimination System, or WPDES). In addition, to allow for retrospective data mining and managing, we are comparing it to the numbers of cows (milking and dry) and the amount of milk shipped from the dairies. Increased water usage in hot months is primarily for cow cooling. **Water conservation measures have been emphasized since 2003.**

University of Wisconsin Extension has reported an average of 40-45 gallons per day per cow for the average dairy farm, in the average year. This includes not only the water they drink, but all water used to wash facilities, milk storage tanks, milking machines, and water to cool the milk and the cows.

For **2017**, our **Irish Dairy averaged 46.6** gallons per milking cow per day; **Elm Dairy averaged 58.8** gallons/milking cow/day... which includes water used to care for an additional 2300 calves and heifers (the result of an efficient artificial insemination breeding program).

Both dairies have repeatedly modernized cow cooling, meaning that even more water goes to cool the herd. It is the right thing to do for the cows, and it will continue as a "win-win" with more stable milk production during hot, humid weather.

What about people's households?

**All Things Considered,
National Public Radio,
5/13/15:**

The mayor of Santa Fe, New Mexico spoke about the results of the city's two tiered water fees. Prior to initiating the fees, Santa Fe averaged 162 gallons water per person per day. After the fees were in place, use dropped to 96 gallons per person per day. (Wisconsin residents average only 56 gallons per person per day)

Summation of Corrected Environmental Errors at Holsum Dairies, 2012-2016:

Liquid manure spills, chronological order	Severity	Brief Summary
June 13, 2012	3	Dry, cracked ground allowed manure to flow directly to tiles
November 2, 2012	3	Nighttime; monitoring procedure incompletely implemented
February 13, 2013	2	Failed clamp in zero-degree weather during snow event
November 5, 2014	3	Worker connected to wrong hose
February 5, 2015	2	Mice chewed pump wiring; late night fix misdirected flow
August 29, 2016	0	Driver spill error due to overgrowth concealing culvert end

Severity Codes:

- 0 == no impact on surface or ground water
- 1==reached adjacent on-dairy dry containment ditch or stormwater retention pond
- 2==reached sediment retention pond(s)
- 3== reached surface water (ditch, stream/pond/lake)
- 4==impacted ground water

By Comparison, the city of Wausau reported on Jan 29th the release of more than 3.7 million gallons of raw sewage was released into the Wisconsin River.

This reference is included for perspective on the often sensationalized agricultural contribution to environmental pollution. Holsum Dairies, LLC remains committed to bettering its environmental performance. And we encourage all progress made by the City of Wausau and other current waters of Wisconsin polluters.

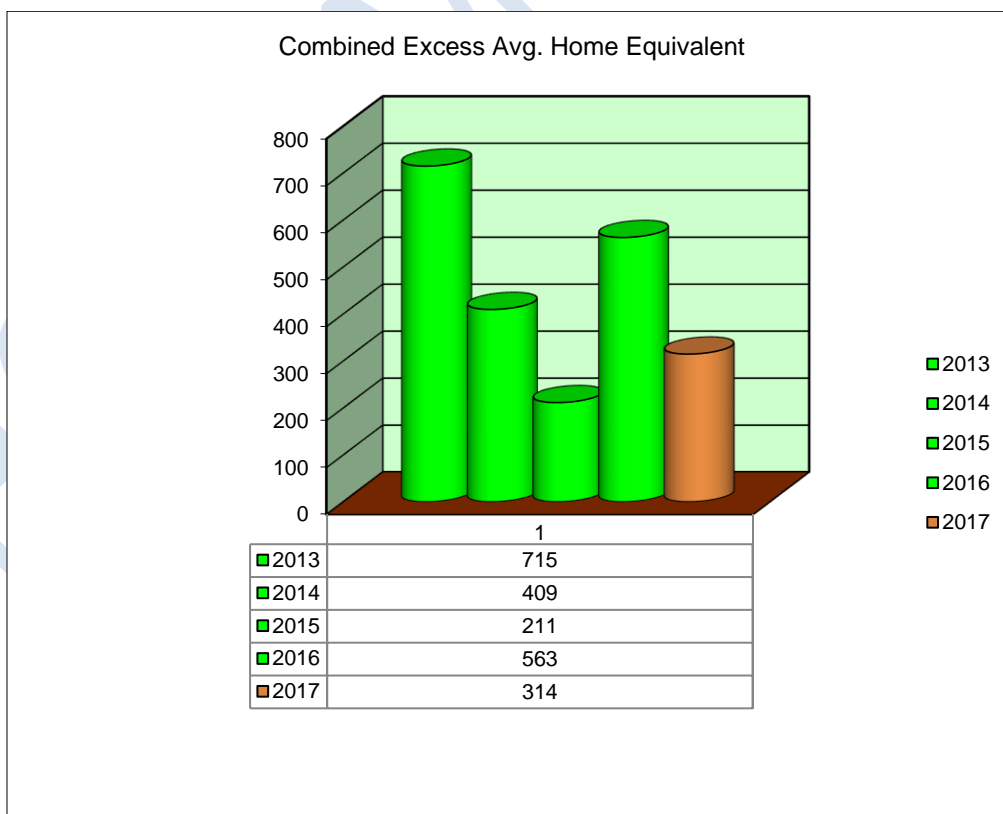
Unregulated topics:

1-Energy Producing Manure Digesters: Below is a record of our operations' electric use and our digesters' production, with a chart (of the most recent five years) showing the numbers of Wisconsin homes (average use) that our excess power can supply.

Kilowatt Hours "Excess" data: Note: a negative number or an unusually low number in an 'Excess' box indicates a period during which mechanical/electrical problems were significant.

Year	Irish Gen, kwh	Irish Use, kwh	Irish Excess, kwh	Elm Gen, kwh	Elm Use, kwh	Elm Excess, kwh	Combined Excess, kwh	Avg. Home Equivalents, WPS data
2013	4,133,444	2,437,891	1,695,553	7,233,193	3,526,432	3,706,761	5,402,314	715
2014	3,968,949	2,536,867	1,432,082	5,281,854	3,618,133	1,663,721	3,095,803	409
2015	3,635,546	2,768,649	866,897	4,539,541	3,809,243	730,298	1,597,195	211
2016	3,860,893	2,722,014	1,138,879	7,389,427	4,274,624	3,114,803	4,253,682	563
2017	2,486,239	2,524,161	-37,922	6,874,510	4,459,048	2,415,462	2,377,540	314

Note: In 2010, and again in 2015, the Elm digester was rebuilt. In 2011 and again in 2017, we rebuilt the Irish digester. The investment, at an approximate cost of \$200,000, created higher generator reliability and a record amount of saleable kWh. As a result, in 2012 and 2013, the dairies far exceeded previous electrical generation from 'waste'.



2-Fossil Fuel Usage in gallons and therms, 2017 parameters:

Liquid Fuel, gallons	2017
Diesel, Irish, total	89,193.10
Diesel, Elm, total	131,246.80
Diesel, direct, Feed Harvest	39,001.30
--Corral Cleaning, Irish	42,355.00
--Corral Cleaning , Elm	72,093.20
--Farm Diesel, Irish	46,838.10
--Farm Diesel, Elm	59,153.60
--Fuel Oil, Irish	0.00
--Fuel Oil, Elm	0.00
Gasoline, Irish	4,683.70
Gasoline, Elm	9,697.60
Propane, Irish	0.00
Propane, Elm	0.00
Nat'l Gas, therms	2017
Natural Gas, Irish, total	87,883.50
Natural Gas, Elm, total	708,230.30
--Digester, Irish	67,517.00
--Digester, Elm	173,895.72
--Calf Ranch	55,544.24
--Parlor, Irish	20,366.50
--Utilities, Elm	38,092.30
--Bedding Dryer, Elm	440,698.04
Carbon dioxide equivalent, metric tons	6,982.00

Calculation constants:

CO₂ produced by each gallon of:

propane = 5.52 kg;

unleaded gasoline = 8.87 kg;

diesel and fuel oil = 10.15 kg;

natural gas/therm = 5.302 kg.

Transportation and Vehicles

Transportation makes up a large part of an organization's overall environmental footprint. After it is cooled, our milk is deposited directly into insulated stainless steel tankers and picked up at the farm by a trucking business. Our primary fuel usage is to power pickup trucks, on-farm implements, and manure application vehicles; (now) natural gas maintains the critical temperature for the anaerobic digesters when the methane powered engines shut down.

One common way to standardize energy use from different fuels is in terms of the carbon dioxide (CO₂) each produces.

Combined vehicle + dryer usage equated to **6982** metric tons of CO₂ in 2017.

3-Energy Used (EPA: 6.91×10^{-4} metric tons CO₂ / kWh (each kWh = 3.608 kg CO₂))

Each kilowatt hour of electricity used (equivalent to about 3-4 hours of television operation) causes the release of 1.6 pounds of carbon dioxide into the air. A small house can easily consume 1,000 kilowatt hours of electricity per month, thus releasing 1,600 pounds (0.727 metric tons) of carbon dioxide in the process.

Irish Dairy's 2017 electrical usage equates to **1744** metric tons of carbon dioxide.

Elm Dairy's 2017 electrical usage equates to **3081** " " " "

(more cows, a calf raising endeavor and manure application enterprise).

2017 total electricity used equates to =**4825** metric tons of CO₂

2017 total vehicle fuel and dryer use equals +**6982** " " "

Total fossil fuel use equates to 11,807 metric tons of CO₂

4-Electricity Produced and Carbon Footprint Reduced

Combined excess electricity in 2017 = 2,377,540 kwh which equals : **1643** metric tons of CO₂

Since electricity produced by cow's methane earns a multiplier of **23**:

Total 2017 CO₂ methane conversion credit = 37,789* metric tons

*this calculated number is consistent with all our previous reporting, which is based on Wisconsin Public Service's reporting of kilowatt hours used and produced.

*****25,982 metric tons net calculated (CO₂) carbon credit*****

---End---